processing circuitry configured to:

    obtain a series of images including movement of at least one object between the series of images; and

    train a machine learning-based system based on the series of images to produce a trained machine learning-based system for providing at least one motion vector indicating a movement of the at least one object between the series of images.

11. The system as claimed in claim **10**, wherein the processing circuitry configured to train comprises processing circuitry configured to minimize a penalized loss function based on a similarity metric.

12. The system as claimed in claim **11**, wherein the similarity metric comprises a cross correlation function for correlating plural images of the series of images.

13. The system as claimed in claim **10**, wherein the series of images comprises a moving image and a fixed image, and wherein the processing circuitry configured to train comprises processing circuitry configured to warp the moving image to the fixed image using a differentiable spatial transform.

14. The system as claim in claim **10**, wherein the machine learning-based system comprises a neural network and the trained machine learning-based system comprises a trained neural network.

15. The system as claimed in claim **10**, wherein the machine learning-based system comprises a neural network and the trained machine learning-based system comprises a trained neural network, and

    wherein the trained neural network comprises the neural network trained using unsupervised training.

16. The system as claimed in claim **10**, wherein the machine learning-based system is trained using PET data.

17. The system as claimed claim **10**, wherein the machine learning-based system is trained using gated PET data.

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